

# Your ticket to ride Turbo transmissions & drive systems for rail vehicles





# Into the future with reliable systems

## Hydrodynamic drive solutions

Economical train operations on the rails of the world call for vehicles that are reliable, robust and durable – with drive components and solutions that on which customers can rely 100 percent. With drives from Voith you will always be on step ahead – now and in the future. Because they ensure maximum operating safety and availability, even under the toughest conditions – be it at minus 25 or plus 45 °C.

### Overall know-how that saves money

As a systems partner, Voith offers you everything your vehicle needs to be optimally suited to its respective application. Voith not only supplies the transmission but also the complete periphery – from cooling system, cardan shafts and gear units up to electronic control systems – from one single source. Your advantage: systems that are perfectly adapted to each other, fewer interfaces and, last but not least, significantly lower service and fuel costs across the entire service life.

With a comprehensive after sales and service portfolio ranging from original spare parts to expert maintenance and overhauls you are always on the safe side with Voith – for up to 30 years and more.

### Advantages you can count on

Snow and ice, sand and heat, salt and humidity, dust and dirt – drive components and solutions from Voith have proven themselves in diesel vehicles even in the toughest conditions. Power densities and efficiencies have been significantly increased over the last few decades. Reliability and economy – and hence the value of ownership of the vehicle – were continuously improved.


### Other benefits:

- + **Worldwide proven, reliable technology**
- + **High failure safety and economy**
- + **Low procurement and life-cycle cost**
- + **Low operating and maintenance cost**
- + **Longer-term spare parts availability, low depreciation**
- + **Flexibility to suit customer-specific special designs**
- + **Comprehensive systems know-how and consultation expertise**
- + **Close contacts to users and OEMs**




# Voith Rail Engine

Future emission standards and the demand for higher efficiency require rail engine development. The efficient and powerful Voith diesel engines are specifically developed to meet the newest requirements and are optimally suited for rail vehicles.

The Voith Rail Engine is the most advanced and efficient diesel engine of its class. Compared to other rail engines, it is characterized by reduced fuel consumption and a high power density. The emission treatment system developed by Voith ensures the engine meets the upcoming European emission regulations including the Stage V (valid in Europe as from 2021) regulation. Voith offers a horizontal and a vertical engine for diesel multiple units as well as locomotives in the output categories 400/450/480 kW.

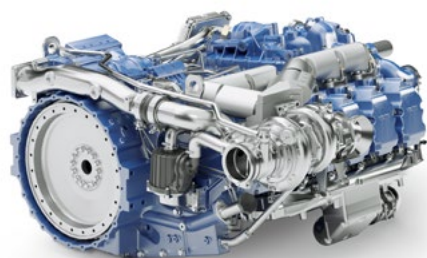
## Voith Rail Engine I6H135 for railcars and special purpose vehicles

Powerful and efficient in the smallest installation space: The I6H diesel engine is a horizontal inline six-cylinder engine that shows its class in a wide range of applications. Together with Voith's exhaust aftertreatment system, the aggregates comply with the emission standards 2016-1628 (stage V) and 97/68 EC (stage IIIB) for rail applications. The emission aftertreatment systems, the motor architecture, the injection system and the engine control are perfectly harmonized. This results in optimum efficiency and lower fuel consumption.

## Voith Rail Engine I6V135 for locomotives, railcars, and special purpose vehicles

Robust design for rail applications: based on the robust design of construction machinery engines the vertical version I6V and horizontal version are ideally suited to rail vehicles. Other designs for example with flat oil pan and auxiliary drives are realized upon customer request.

### Voith Rail Engine I6H135 – horizontal



### Voith Rail Engine I6V135 – vertical



### Technical data

Engine	Horizontal
Cylinder	6
Displacement [l]	13,5
Emission standard acc. 2016-1628 & 97/68 EC	Stage V & Stage IIIB
Rated power [kW]	400/450/480
Rated speed [rpm]	2 100
Max. torque [Nm]	2 400/2 600/2 800
Broke/stroke [mm]	135/157
Compression ratio	17:1
Dry weight [kg]	1 200

All data preliminary

Vertical
6
13,5
Stage V & Stage IIIB
400/450/480
2 100
2 400/2 600/2 800
135/157
17:1
1 150



# Robust and virtually wear-free Railcar transmissions with extremely high mileages

Drive solutions from Voith are robust, reliable and virtually wear-free – at extremely high mileages. In many cases, operators are able to exceed the mileage limits up to the first recommended major overhaul quite considerably. The maintenance requirements largely consist of regular transmission oil checks.

DIWARail



T 211 re.4



T 212 bre







- 1 Railcar with turbo transmission T 212 bre
- 2 BomSinal railbus with DIWARail
- 3 Class 2200 railcar with T 211 re.4 turbo transmission

Voith offers a wide range of turbo transmissions in the power range up to 650 kW. The DIWARail transmission derives from the 100 000-times proven DIWA bus transmission and offers an input power of up to 320 kW. The world's bestselling railcar transmission, the T 211 re.4 for up to 350 kW, is internationally established. The T 212 bre is suitable for high-speed railcars with input powers of up to 450 kW. The T 312 transmission is state-of-the-art in applications up to 650 kW.

#### DIWARail

Originally designed for citybuses, DIWARail is the most successful and best-selling hydromechanical transmission in the 320 kW class. With its contra-rotating differential converter acting as a hydrodynamic brake, it significantly reduces wear across the entire speed range. With the power-split principle in first gear (achieved by a differential converter), as well as mechanical power transmission up to 4th gear, the DIWARail is ideal for rail vehicles in the lower output range. The latest version with reinforced PTO, secondary lube pump and integrated reversing gear also allows towing while the engine is switched off. It is also possible for the vehicle to coast without being decelerated by a motored engine.

#### T 211 re.4

Insensitive to climatic influences, isolated from vibrations, low life-cycle costs – with 7 500 units sold, the world's best-selling rail car transmission. With a transmission input power of 350 kW, the T 211 re.4 has been adapted to the new generation of 6-cylinder diesel engines. The new VTDC drive control with monitoring and diagnosis function as well as an operating data storage facility is directly installed to the transmission. Available as an option: a hydrodynamic brake that can be integrated into the vehicle braking system (blending).

#### T 212 bre

With its high efficiency and a maximum input power of 450 kW, the T 212 bre is ideal for high-speed railcars up to 180 km/h or multiple units with high driving outputs. The 3-speed transmission with hydrodynamic torque converter, two hydrodynamic couplings, an integrated retarder and a mechanical reversing gear excels by smooth, virtually wear-free starting. At the same time it adapts the tractive effort automatically and steplessly to the prevailing rolling resistance. The transmission is insensitive to vibrations and thermal or mechanical overloads – and all this with mileages of over 1.2 million km before the next major overhaul (depending on operating conditions).

#### T 312 bre



#### T 312 bre

The high efficiency and input power of up to 650 kW make the T 312 bre an ideal transmission for high-speed railcars that achieve speeds up to 220 km/h. It excels with its smooth, almost wear-free starting. The tractive effort is automatically and steplessly adapted to the prevailing rolling resistance. The transmission is insensitive to vibrations as well as thermal and mechanical overloads.



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# Our challenges are specific solutions

## Transmissions for special purpose vehicles

Components and systems for special purpose vehicles have to meet highly specific requirements. Track and rail embankment repairs or overhead wire modernizations do not only require lengthy low-speed trips and frequent shunting, they also need readily available machine powers for external operations.

L 311 reV2



L 220 reV2



S111 re.2







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- 6 Tamping Express 09-4X with L 311 reV2 turbo transmission
- 7 UST 02 ultra-sonic measuring vehicle with RailPack T 212

For this reason, transmissions that have been developed especially for such applications, for example the L 220 reV2 or the L 311 reV2, feature numerous PTOs for the installation of hydrostatic components that support low-speed trips. Via connectable hydrostatic pumps, external machines such as tamping devices, compressors, platforms and cranes can be operated. Within this heavy-duty portfolio, Voith is the world's number one transmission supplier.

#### L 311 reV2

The L 311 turbo transmission was developed especially for the main drives of track construction and special purpose vehicles, as well as small locomotives with a maximum speed of 120 km/h and transmission input powers of up to 650 kW. Depending on the application, up to eight PTOs are available. During operation, the PTOs can provide the full engine power. If required, there is also a drive shaft that can be utilized for transmitting the engine output to other components. For extremely low-speed operation, the L 311 reV2 offers a flange option for a hydrostatic motor at the low output gear unit. Control functions are assumed by the VTDC drive control.

#### L 220 reV2

The L 220 reV2 turbo transmission constitutes the development of a completely new transmission concept for shunting locomotives and special vehicles. With a transmission input power of 350 kW and up to four PTOs it allows the direct installation of high-performance hydrostatic pumps.

#### S111 re.2

Be it diesel-hydraulic, diesel-mechanical or diesel-electric rail vehicles – as one of the world's leading systems suppliers, Voith offers a solution for all types of diesel drive systems. Our hydrodynamic transmission S111 complements the product range: With a maximum transmission input power of 250 kW, it is designed for small special purpose vehicles. Due to its compact design, which makes it ideal for even the smallest installation spaces, the transmission offers essential advantages in combination with low operating costs.

- 6 3-axle industrial locomotive with L 3r4 zseU2 turbo reversing transmission
- 7 Railcar with RailPack 400DM
- 8 Railcar with RailPack 600DH



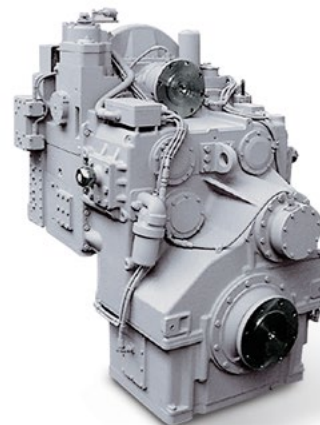
# For every tractive effort Locomotive transmission from Voith

## L3r4 zseU2.

The L3r4 zseU2 turbo reversing transmission has been designed for diesel locomotives with maximum speeds of up to 60 km/h. The version with range-change gear is capable of up to 100 km/h. The transmission allows precise speed maintenance – constant speeds of 2 to 5 km/h are possible. The turbo reversing transmission has two torque converters for each driving direction. The converters for the opposite driving direction can be used for dynamic braking up to 300 kW and short-term braking up to 380 kW.

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## L 3r4 zseU2







# Perfectly matched and from one single source Comprehensive systems know-how

As the specialist for diesel-driven rail vehicles with more than 80 years of experience on the rails of the world, Voith is the sole supplier in the power class from 300 to 735 kW. There is no other manufacturer with such a selection of in-house produced components – and such a wealth of systems know-how.

## One for all – and everything from one unit: Voith RailPacks

Nobody has more systems know-how for complete drives and for driveline technology than a manufacturer that produces nearly all components in-house. This is why Voith RailPacks are setting new standards for diesel railcar drives. In addition, Voith carries out individual retrofit and repowering projects with its customers.

Apart from basic package solutions in the power classes 400, 600 and 800 kW, Voith also offers specific solutions for customers all over the world.

## Diesel-electric RailPacks

All RailPacks are in principle also available for electric traction. The electric tractive effort is generated by a motor-side-driven traction generator.

# Diesel drive systems

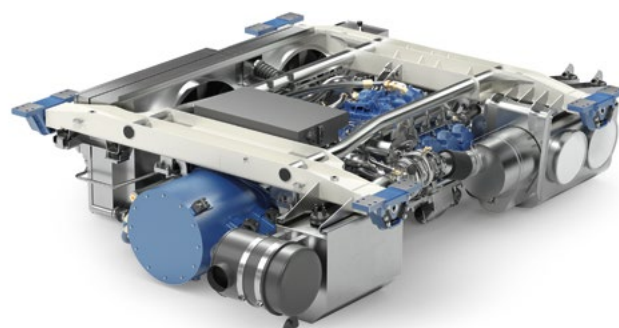
## RailPacks

RailPacks are drive systems for use in single-segment and multi-segment diesel railcars for commuter, regional, national and Intercity service.

### Special features

- Engines from other manufacturers can be integrated
- Broad output spectrum from 400 kW to 735 kW
- Complete customer service from consultation on vehicle construction and inspection up to full service
- Worldwide sales and service network for rail applications
- Low calculable life cycle costs
- Hybridization possible
- Consumption-optimized VTDCo control
- Meets all current emission standards

### RailPack 500DE



### Basic versions

- RailPack 400 DH/DM/DE engine power up to 400 kW
- RailPack 500 DH/DM/DE engine power up to 480 kW
- RailPack 600 DH/DE engine power up to 588 kW
- RailPack 800 DH/DE engine power up to 735 kW

### Technical Data

Basic data	RailPack 400DM	RailPack 400DH	RailPack 500DH	RailPack 600DH	RailPack 800DH	RailPack 400/500 & 600/800DE
Transmission	DIWARail	S 111 re.1 oder T 211 re.4 + KB190	T212 bre	T212 bre	T312 bre	Generator
Engine	Voith I6H135-R3/5-400	Voith I6H135-R3/5-400/450	Voith I6H135-R3/5-480	12 cylinder	12 cylinder	Voith I6H135-R3/5 oder 12 cylinder*
Engine power	400 kW	400–450 kW	480 kW	588–662 kW	735 kW	400–735 kW
Speed	80–120 km/h	80–140 km/h	100–160 km/h	120–160 km/h	140–200 km/h	80–200 km/h

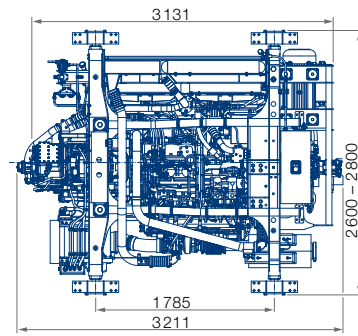
\*or other engines >500 kW



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### RailPack 400/500DM

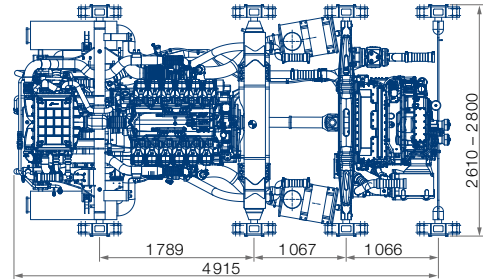
The proven Voith DIWARail transmission was reworked and the transmission input power increased for the RailPack 400/500DM. The RailPack 400/500DM is ideally suited for all single-segment or multi-segment light rail cars because of the broad traction range and the maximum engine power of up to 480 kW.



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### RailPack 800 DH

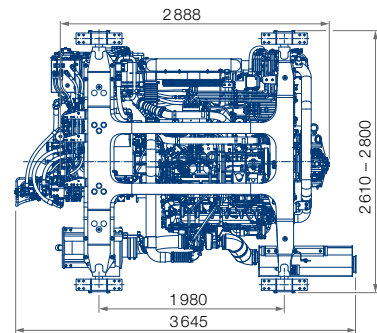
The maximum performance RailPack 800DH is the RailPack with the T312 turbo transmission. The RailPack 800DH is designed for a power output of up to 735 kW. It is perfectly suited for railcars with maximum speeds between 140 and 200 km/h.



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### RailPack 400DH/500DH

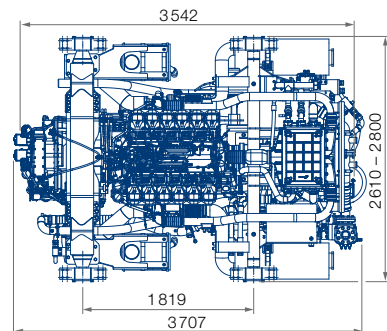
The RailPack 400/500DH is available in this version with the T211 turbo transmission and a maximum engine power reaching 480 kW. The RailPack 500DH is equipped with the T212 turbo transmission for a maximum engine power of 480 kW.



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### RailPack 600DH

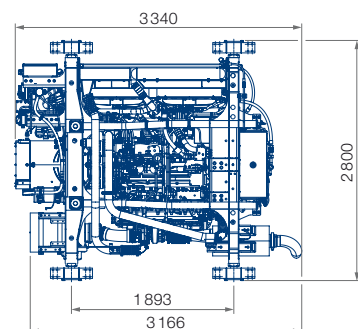
The RailPack 600DH is primarily suited for use in railcars having a maximum speed of 120 to 160 km/h since very high efficiency is available over a wide range of speeds because two hydrodynamic couplings are used.



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### RailPack 400/500/600DE

Diesel-electric RailPacks are available with engine powers ranging from 294 kW to 588 kW and are ideally suited for railcars. The drive generators integrated into the system form an essential component of the RailPacks. Together with other Voith components, they form an entire diesel-electrical drive chain.



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for Generations